

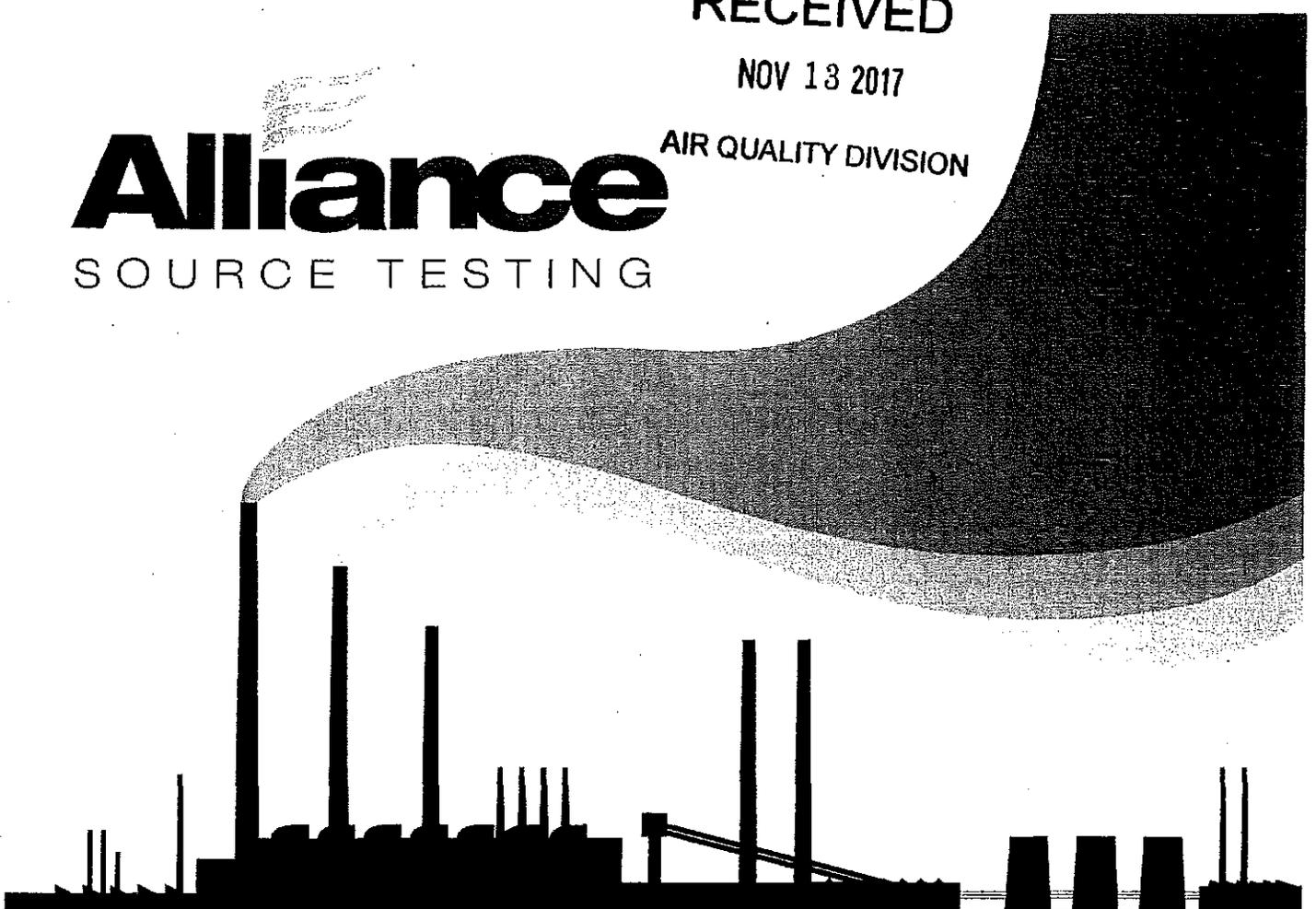
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**Alliance**

SOURCE TESTING



## Source Test Report

Real Alloy Recycling, Inc  
267 North Fillmore Road  
Coldwater, MI 49036  
(South)

Test Dates:  
September 12-14, 2017 &  
October 11-12, 2017

AST Project Nos.  
2017-0432 & 2017-0749

**The  
Alliance  
Advantage**

## 1.0 Introduction

Alliance Source Testing, LLC (AST) was retained by Real Alloy Recycling, Inc. (RAR) to conduct compliance testing at the Coldwater (S), Michigan facility. Portions of the facility are subject to provisions of the National Emission Standards for Hazardous Air Pollutants (NESHAP) for Secondary Aluminum Production facilities as detailed in 40 CFR 63, Subpart RRR and the Michigan Department of Environment Quality (MDEQ) Title V Permit No. M1-ROP-N5957-2012e. Testing was conducted to demonstrate compliance with provisions in the MDEQ permit and the NESHAP.

Testing was conducted to determine the emission rates of filterable particulate matter (PM), hydrogen chloride (HCl) and dioxins and furans (D/F) from Rotary Furnaces 1 and 2; the emission rate of nitrogen oxides (NOx) from Rotary Furnace 2 while operating with a trial LTOF burner; and the emission rates of PM, particulate matter less than 10 microns (PM10), particulate matter less than 2.5 microns (PM2.5), HCl and non-methane volatile organic compounds (NMVOC) from the baghouse stack.

Testing was conducted at three (3) locations – Rotary Furnace 1 duct (Rotary #1S), Rotary Furnace 2 duct (Rotary #2S) and the baghouse stack for two (2) operating conditions: (1) processing Dross and (2) processing Scrap in both furnaces simultaneously. The following table outlines the parameters that were tested at each location and condition.

Condition	Location	Parameters	Methods
Dross	Baghouse Stack	PM, PM10, PM2.5, HCl	1-4, 5, 26A, 201A/202
	Rotary #1S	HCl	1-4, 26
	Rotary #2S	NOx, HCl	1-4, 7E, 26
Scrap	Baghouse Stack	D/F, NMVOC	1-4, 23/ALT-034, 25A, 320
	Rotary #1S	D/F	1-4, 23/ALT-034
	Rotary #2S	D/F	1-4, 23/ALT-034

Pollutant contributions for HCl and D/F from each furnace were determined by testing the outlets of each source individually (prior to the baghouse) and establishing the pollutant contribution percentage from each unit to the overall emissions profile. Therefore, in accordance with 40 CFR 63.1511, the contribution of each pollutant from the applicable units was applied to the total baghouse outlet emissions to establish compliance with the individual unit limitations for each furnace.

## 1.1 Facility Description

RAR is a secondary aluminum production facility (SIC 3341) which produces molten aluminum and specification ingot from the melting and recovery of aluminum from aluminum scrap, sow and pig. The recovery of aluminum from aluminum scrap and the subsequent production of molten aluminum and/or specification ingot have been defined by the United States Environmental Protection Agency (EPA) as secondary aluminum production processes.

**1.2 Process/Control System Descriptions**

The rotary furnaces are used to process aluminum dross and scrap aluminum. Each furnace is designed to rotate on its axis, mixing and tumbling the charge while heating. The furnace then tilts forward to pour out the molten aluminum (tapping) and dump out the remaining slag or Salt Cake.

Included with the metal charge is the feed of a salt flux material. The scrap or dross charge and salt mixture is rotated in the furnace while a natural gas burner directed into the open end of the furnace heats the mixture. When all of the aluminum in the batch has melted, the furnace is tilted forward and the molten aluminum is poured into crucibles for transport, transferred to the reverberatory furnace or poured into sow molds to solidify. The remaining slag or salt cake is dumped out of the furnace by tilting and rotating into pans for cooling and ultimately disposal.

Emissions from these process units are captured by a hood and directed to a lime reagent injected baghouse system for control of the regulated pollutants. The emission control system injects the lime into the air stream prior to the inlet of the baghouse to reduce the concentration of specific pollutants present in the exhaust gases. The baghouse then captures the reacted material and other particulate matter from the melting process.

**1.3 Project Team**

Personnel involved in this project are identified in the following table.

**Table 1-1  
Project Team**

<b>RAR Personnel</b>	Janine Caldwell Jeff Ferg
<b>Regulatory Personnel</b>	Cody Yazzie – MDEQ Dave Patterson – MDEQ
<b>AST Personnel</b>	Adam Robinson Pete Merranko Jarred Sproull Brandon Cole Jef Fearon Jonathan Cervantes Jordon Lovell Andy Roth Ryan Moss Kenji Kinoshita Justin Bernard

**1.4 Site Specific Test Plan & Notification**

Testing was conducted in accordance with the Site Specific Test Plans (SSTP) submitted to Karen Kajiya-Mills and Rex Lane of the MDEQ on June 29, 2017 and October 2, 2017.

### 1.5 Test Program Notes

The SSTP indicated that U.S. Reference Test Method 25A would be used to collect total hydrocarbon data at the baghouse stack. However, the test program was adjusted during the onsite testing to include U.S. EPA Reference Test Method 320 in conjunction with U.S. EPA Reference Test Method 25A to determine the emission rate of NMVOC.

Pollution control equipment issues were identified after the September testing event initiated. Maintenance was performed on the control equipment prior to conducting the October PM retest.

On October 11, 2017, Run 1 was voided due to a process upset which results in property damage to the hot metal launder (trough) under Rotary #2S which halter further testing until repaired. A copy of the voided field data is provided in Appendix H. Particulate matter testing on the baghouse stack was initiated and completed on October 12, 2017.

## **2.0 Summary of Results**

AST conducted compliance testing at the RAR facility in Coldwater (S), Michigan on September 12-14, 2017 and October 11-12, 2017. Testing consisted of determining the emission rates of PM, HCl and D/F from Rotary Furnaces 1 and 2; the emission rate of NO<sub>x</sub> from Rotary Furnace 2 while operating with a trial LTOF burner; and the emission rates of PM, PM<sub>10</sub>, PM<sub>2.5</sub>, HCl and NMVOC from the baghouse stack.

Tables 2-1 through 2-4 provide summaries of the emission testing results with comparisons to the applicable NESHAP and/or permit limits. These tables also provide summaries of the process operating and control system data collected during testing. Any difference between the summary results listed in the following table and the detailed results contained in appendices is due to rounding for presentation.

**Table 2-1**  
**Summary of Testing Results – Rotary Furnace No. 1**

Emissions Data				
Run Number	Run 1	Run 2	Run 3	Average
Date	9/12/17	9/12/17	9/13/17	--
<b>Particulate Matter Data</b>				
Filterable PM Emission Factor, lb/ton	1.2	0.90	0.25	0.79
NESHAP Limit, lb/ton	--	--	--	0.40
Percent of Limit, %	--	--	--	>100
<b>Hydrogen Chloride Data</b>				
HCl Emission Factor, lb/ton	0.052	0.012	0.0047	0.023
NESHAP Limit, lb/ton	--	--	--	0.40
Percent of Limit, %	--	--	--	6
Run Number	Run 1	Run 2	Run 3	Average
Date	9/13/17	9/14/17	9/14/17	--
<b>Dioxin/Furan Data</b>				
D/F Emission Factor, grain TEQ/ton <sup>1</sup>	4.3E-05	7.2E-05	4.0E-04	1.7E-04
NESHAP Limit, grain TEQ/ton	--	--	--	2.1E-04
Percent of Limit, %	--	--	--	81
Process Operating / Control System Data				
Run Number	Run 1	Run 2	Run 3	Average
Date	9/12/17	9/12/17	9/13/17	--
RF No. 1 Feed Rate, lb/hr	10,568	10,794	10,103	10,488
RF No. 1 Flux Percentage, %	24.3	26.2	26.0	25.5
Lime Injection Rate, lb/hr	174.7	148.3	200.3	174.4
Run Number	Run 1	Run 2	Run 3	Average
Date	9/13/17	9/14/17	9/14/17	--
RF No. 1 Feed Rate, lb/hr	10,197	9,246	8,111	9,185
Baghouse Inlet Temperature, °F	173	198	216	196

Note: HCl and D/F contributions from the furnaces were determined during the onsite testing program. The detailed results are provided in Appendix B.

<sup>1</sup> D/F TEQ values were calculated using 1989 NATO TEFs.

**Table 2-2  
Summary of Testing Results – Rotary Furnace No. 2**

Emissious Data				
Run Number	Run 1	Run 2	Run 3	Average
Date	9/12/17	9/12/17	9/13/17	--
<b>Particulate Matter Data</b>				
Filterable PM Emission Factor, lb/ton	1.2	0.92	0.25	0.81
NESHAP Limit, lb/ton	--	--	--	0.40
Percent of Limit, %	--	--	--	>100
<b>Hydrogen Chloride Data</b>				
HCl Emission Factor, lb/ton	0.069	0.020	0.0051	0.031
NESHAP Limit, lb/ton	--	--	--	0.40
Percent of Limit, %	--	--	--	8
<b>Nitrogen Oxides Data</b>				
NOx Emission Factor, lb/ton	0.50	0.29	0.92	0.57
MDEQ Permit Limit, lb/ton	--	--	--	0.754
Percent of Limit, %	--	--	--	76
Run Number	Run 1	Run 2	Run 3	Average
Date	9/13/17	9/14/17	9/14/17	--
<b>Dioxin/Furan Data</b>				
D/F Emission Factor, grain TEQ/ton <sup>1</sup>	2.3E-05	1.3E-04	2.4E-04	1.3E-04
NESHAP Limit, grain TEQ/ton	--	--	--	2.1E-04
Percent of Limit, %	--	--	--	62
Process Operating / Control System Data				
Run Number	Run 1	Run 2	Run 3	Average
Date	9/12/17	9/12/17	9/13/17	--
RF No. 2 Feed Rate, lb/hr	10,191	10,620	9,943	10,251
RF No. 2 Flux Percentage, %	23.0	25.9	26.1	25.0
Lime Injection Rate, lb/hr	174.7	148.3	200.3	174.4
Run Number	Run 1	Run 2	Run 3	Average
Date	9/13/17	9/14/17	9/14/17	--
RF No. 2 Feed Rate, lb/hr	10,130	9,300	10,062	9,831
Baghouse Inlet Temperature, °F	173	198	216	196

Note: HCl and D/F contributions from the furnaces were determined during the onsite testing program. The detailed results are provided in Appendix B.

<sup>1</sup> D/F TEQ values were calculated using 1989 NATO TEFs.

**Table 2-3**  
**Summary of Testing Results – Baghouse Stack**

<b>Emissions Data</b>				
<b>Run Number</b>	<b>Run 1</b>	<b>Run 2</b>	<b>Run 3</b>	<b>Average</b>
<b>Date</b>	<b>9/12/17</b>	<b>9/12/17</b>	<b>9/13/17</b>	<b>--</b>
<b>Particulate Matter Data</b>				
Filterable PM Emission Factor, lb/ton	0.61	0.46	0.13	0.40
MDEQ Permit Limit, lb/ton	--	--	--	0.131
Percent of Limit, %	--	--	--	>100
PM2.5 Emission Factor, lb/ton <sup>1</sup>	0.41	0.40	0.090	0.30
MDEQ Permit Limit, lb/ton	--	--	--	0.292
Percent of Limit, %	--	--	--	>100
PM10 Emission Factor, lb/ton <sup>2</sup>	0.63	0.52	0.12	0.43
MDEQ Permit Limit, lb/ton	--	--	--	0.737
Percent of Limit, %	--	--	--	58
<b>Hydrogen Chloride Data</b>				
HCl Emission Factor, lb/ton	0.060	0.016	0.0049	0.027
MDEQ Permit Limit, lb/ton	--	--	--	0.080
Percent of Limit, %	--	--	--	34
<b>Run Number</b>	<b>Run 1</b>	<b>Run 2</b>	<b>Run 3</b>	<b>Average</b>
<b>Date</b>	<b>9/13/17</b>	<b>9/14/17</b>	<b>9/14/17</b>	<b>--</b>
<b>Non-Methane Volatile Organic Compounds Data</b>				
NMVOC Emission Factor, lb/ton	2.2	0.90	1.4	1.5
MDEQ Permit Limit, lb/ton	--	--	--	1.600
Percent of Limit, %	--	--	--	93
<b>Process Operating / Control System Data</b>				
<b>Run Number</b>	<b>Run 1</b>	<b>Run 2</b>	<b>Run 3</b>	<b>Average</b>
<b>Date</b>	<b>9/12/17</b>	<b>9/12/17</b>	<b>9/13/17</b>	<b>--</b>
Total Feed Rate, lb/hr	20,759	21,414	20,046	20,740
<b>Run Number</b>	<b>Run 1</b>	<b>Run 2</b>	<b>Run 3</b>	<b>Average</b>
<b>Date</b>	<b>9/13/17</b>	<b>9/14/17</b>	<b>9/14/17</b>	<b>--</b>
Total Feed Rate, lb/hr	20,327	18,546	18,173	19,015

<sup>1</sup> PM2.5 is the summation of the filterable PM2.5 and condensable PM fractions.

<sup>2</sup> PM10 is the summation of the filterable PM2.5, filterable PM10 and condensable PM fractions.

**Table 2-4**  
**Summary of Testing Results – Particulate Matter Retest**

<b>Emissions Data</b>				
<b>Run Number</b>	<b>Run 2</b>	<b>Run 3</b>	<b>Run 4</b>	<b>Average <sup>1</sup></b>
<b>Date</b>	<b>10/12/17</b>	<b>10/12/17</b>	<b>10/12/17</b>	<b>--</b>
<b>PM Data - Baghouse Stack</b>				
Filterable PM Emission Factor, lb/ton	0.047	0.048	0.050	0.048
MDEQ Permit Limit, lb/ton	--	--	--	0.131
<b>Percent of Limit, %</b>	--	--	--	<b>37</b>
<b>PM2.5 Emission Factor, lb/ton <sup>2</sup></b>				
PM2.5 Emission Factor, lb/ton <sup>2</sup>	0.13	0.20	0.21	0.18
MDEQ Permit Limit, lb/ton	--	--	--	0.292
<b>Percent of Limit, %</b>	--	--	--	<b>61</b>
<b>PM10 Emission Factor, lb/ton <sup>3</sup></b>				
PM10 Emission Factor, lb/ton <sup>3</sup>	0.13	0.21	0.22	0.19
MDEQ Permit Limit, lb/ton	--	--	--	0.737
<b>Percent of Limit, %</b>	--	--	--	<b>26</b>
<b>PM Data - Rotary Furnace No. 1</b>				
Filterable PM Emission Factor, lb/ton	0.095	0.097	0.098	0.097
NESHAP Limit, lb/ton	--	--	--	0.40
<b>Percent of Limit, %</b>	--	--	--	<b>24</b>
<b>PM Data - Rotary Furnace No. 2</b>				
Filterable PM Emission Factor, lb/ton	0.093	0.096	0.10	0.097
NESHAP Limit, lb/ton	--	--	--	0.40
<b>Percent of Limit, %</b>	--	--	--	<b>24</b>
<b>Process Operating / Control System Data</b>				
<b>Run Number</b>	<b>Run 2</b>	<b>Run 3</b>	<b>Run 4</b>	<b>Average</b>
<b>Date</b>	<b>10/12/17</b>	<b>10/12/17</b>	<b>10/12/17</b>	<b>--</b>
Total Feed Rate, lb/hr	22,418	24,063	24,027	23,503

<sup>1</sup> Test Run 1 was voided – see Section 1.5.

<sup>2</sup> PM2.5 is the summation of the filterable PM2.5 and condensable PM fractions.

<sup>3</sup> PM10 is the summation of the filterable PM2.5, filterable PM10 and condensable PM fractions.

### 3.0 Testing Methodology

The emission testing program was conducted in accordance with the test methods listed in Table 3-1. Method descriptions are provided below while quality assurance/quality control data is provided in Appendix D.

**Table 3-1  
Source Testing Methodology**

Parameter	U.S. EPA Reference Test Methods	Notes/Remarks
Volumetric Flow Rate	1 & 2	Full Velocity Traverses
Oxygen / Carbon Dioxide	3	Integrated Bag / Fyrite Analysis
Oxygen / Carbon Dioxide	3 / 3A	Integrated Bag / Instrumental Analysis
Oxygen / Carbon Dioxide	3A	Instrumental Analysis
Moisture Content	4	Volumetric / Gravimetric Analysis
Particulate Matter	5	Isokinetic Sampling
Particulate Matter / Hydrogen Chloride	5 / 26A	Isokinetic Sampling
Nitrogen Oxides	7E	Instrumental Analysis
Dioxins / Furans	23 / ALT-034	Isokinetic Sampling
Non-Methane Volatile Organic Compounds	25A / 320	Instrumental Analysis
Hydrogen Chloride	26	Constant Rate Sampling
Particulate Matter <10 Microns / Particulate Matter <2.5 Microns	201A / 202	Constant Rate Sampling
Gas Dilution System Certification	205	--

#### 3.1 U.S. EPA Reference Test Methods 1 and 2 – Sampling/Traverse Points and Volumetric Flow Rate

The sampling location and number of traverse (sampling) points were selected in accordance with U.S. EPA Reference Test Method 1. To determine the minimum number of traverse points, the upstream and downstream distances were equated into equivalent diameters and compared to Figure 1-1 (for isokinetic sampling) and/or Figure 1-2 (measuring velocity alone) in U.S. EPA Reference Test Method 1.

Full velocity traverses were conducted in accordance with U.S. EPA Reference Test Method 2 to determine the average stack gas velocity pressure, static pressure and temperature. The velocity and static pressure measurement system consisted of a pitot tube and inclined manometer. The stack gas temperature was measured with a K-type thermocouple and pyrometer.

#### 3.2 U.S. EPA Reference Test Method 3 – Oxygen/Carbon Dioxide

The oxygen (O<sub>2</sub>) and carbon dioxide (CO<sub>2</sub>) testing was conducted in accordance with U.S. EPA Reference Test Method 3. One (1) integrated Tedlar bag sample was collected during each test run. The bag samples were analyzed on site with a Fyrite O<sub>2</sub>/CO<sub>2</sub> analyzer. The Fyrite solutions were verified by conducting a calibration check with EPA Protocol 1 O<sub>2</sub>/CO<sub>2</sub> gas. The remaining stack gas constituent was assumed to be nitrogen for the stack gas molecular weight determination.

### **3.3 U.S. EPA Reference Test Method 3/3A – Oxygen/Carbon Dioxide**

The oxygen (O<sub>2</sub>) and carbon dioxide (CO<sub>2</sub>) testing was conducted in accordance with U.S. EPA Reference Test Method 3/3A. One (1) integrated Tedlar bag sample was collected during each test run. The bag samples were analyzed on site with a gas analyzer. The remaining stack gas constituent was assumed to be nitrogen for the stack gas molecular weight determination. The quality control measures are described in Section 3.14.

### **3.4 U.S. EPA Reference Test Method 3A – Oxygen/Carbon Dioxide**

The oxygen (O<sub>2</sub>) and carbon dioxide (CO<sub>2</sub>) testing was conducted in accordance with U.S. EPA Reference Test Method 3A. Data was collected online and reported in one-minute averages. The sampling system consisted of a stainless-steel probe, Teflon sample line(s), gas conditioning system and the identified gas analyzer. The gas conditioning system was a non-contact condenser used to remove moisture from the stack gas. If an unheated Teflon sample line was used, then a portable non-contact condenser was placed in the system directly after the probe. Otherwise, a heated Teflon sample line was used. The quality control measures are described in Section 3.14.

### **3.5 U.S. EPA Reference Test Method 4 – Moisture Content**

The stack gas moisture content was determined in accordance with U.S. EPA Reference Test Method 4. The gas conditioning train consisted of a series of chilled impingers. Prior to testing, each impinger was filled with a known quantity of water or silica gel. Post testing, the quantities of water and silica gel were measured to determine the amount of moisture condensed during the test run. Alternatively, each impinger was analyzed gravimetrically before and after each test run on the same balance to determine the amount of moisture condensed.

### **3.6 U.S. EPA Reference Test Method 5 – Particulate Matter**

The filterable particulate matter testing was conducted in accordance with U.S. EPA Reference Test Method 5. The complete sampling system consisted of a Teflon-coated nozzle, heated glass-lined probe, pre-weighed heated quartz filter, gas conditioning train, pump and calibrated dry gas meter. The gas conditioning train consisted of four (4) chilled impingers – the first and second containing 100 mL of H<sub>2</sub>O, an empty third impinger and the fourth containing 200-300 grams of silica gel. The probe liner and filter heating systems were maintained at a temperature of 120 ± 14°C (248 ± 25°F) and the impinger temperature was maintained at 20°C (68°F) or less throughout the testing.

Following the completion of each test run, the sampling train was leak checked at a vacuum pressure greater than or equal to the highest vacuum pressure observed during the run, and the contents of the impingers were measured for moisture gain. The probe and nozzle were rinsed and brushed three (3) times with acetone to remove any adhering particulate matter. This rinse was recovered in container 1. The front half of the filter holder was rinsed three (3) times with acetone and this rinse was added to container 1. The pre-weighed quartz filter was carefully removed and placed in container 2. All containers were sealed, labeled and liquid levels marked for transport to the identified laboratory.

### 3.7 U.S. EPA Reference Test Methods 5 and 26A – Particulate Matter/Hydrogen Chloride

The filterable particulate matter and hydrogen chloride (HCl) testing was conducted in accordance with U.S. EPA Reference Test Methods 5 and 26A. The complete sampling system consisted of a Teflon-coated nozzle, heated glass-lined probe, pre-weighed heated Teflon filter, gas conditioning train, pump and calibrated dry gas meter. The gas conditioning train consisted of four (4) chilled impingers. The first and second impingers contained 100 mL of 0.1 N H<sub>2</sub>SO<sub>4</sub>, the third was initially empty and the fourth contained 200-300 grams of silica gel. The probe liner and filter heating systems were maintained at 248-273°F, and the impinger temperature was maintained at 20°C (68°F) or less throughout the testing.

Following the completion of each test run, the sampling train was leak checked at vacuum pressure greater than or equal to the highest vacuum pressure observed during the run and the contents of the impingers were measured for moisture gain. The pre-weighed Teflon filter was carefully removed and placed in container 1. The probe and nozzle were rinsed and brushed three (3) times with acetone to remove any adhering particulate matter and these rinses placed in container 2. The front half of the filter holder was rinsed three (3) times with acetone and this rinse was added to container 2. The absorbing solution (0.1 N H<sub>2</sub>SO<sub>4</sub>) from the first and second impingers was placed into sample container 3. The back-half of the filter holder, first, second and third impingers and all glassware leading to the outlet of the third impinger were rinsed with de-ionized (DI) water. These rinses were also placed in container 3. Containers 1-2 were sealed, labeled and liquid levels marked for transport to the identified laboratory for particulate analysis. Container 3 was sealed, labeled and liquid levels marked for transport to the identified laboratory for halide analysis.

### 3.8 U.S. EPA Reference Test Method 7E – Nitrogen Oxides

The nitrogen oxides (NO<sub>x</sub>) testing was conducted in accordance with U.S. EPA Reference Test Method 7E. Data was collected online and reported in one-minute averages. The sampling system consisted of a stainless-steel probe, Teflon sample line(s), gas conditioning system and the identified gas analyzer. The gas conditioning system was a non-contact condenser used to remove moisture from the stack gas. If an unheated Teflon sample line was used, then a portable non-contact condenser was placed in the system directly after the probe. Otherwise, a heated Teflon sample line was used. The quality control measures are described in Section 3.14.

### 3.9 U.S. EPA Reference Test Method 23/Alternative Method 034 – Dioxins/Furans

The dioxins and furans (D/F) testing was conducted in accordance with U.S. EPA Reference Test Method 23 with guidance from Alternative Method 034. The sampling system consisted of a glass nozzle with a heated glass-lined probe or a Teflon-coated nozzle with a heated stainless steel-lined probe, glass filter holder with pre-cleaned heated glass-fiber filter, condenser coil, XAD sorbent module, gas conditioning train, pump and calibrated dry gas meter. The gas conditioning system consisted of four (4) to five (5) chilled impingers. The first impinger was empty. The next one (1) or two (2) impingers each contained 100 mL of water. The next impinger was empty while the last impinger was charged with 200-300 grams of silica gel. The probe liner and filter heating systems were maintained at a temperature of 120 ± 14°C (248 ± 25°F), and the impinger temperature was maintained below at 20°C (68°F) or less throughout testing.

All glassware leading to the XAD adsorbing resin trap was cleaned and sealed before mobilizing to the site. The sampling train was assembled in the sample recovery area. The glass-fiber filter was placed in a glass filter holder with a Teflon filter support and connected to the condenser coil. All open ends of the sampling train were sealed with Teflon tape prior to complete assembly at the sampling location.

Following the completion of each test run, the sampling train was leak checked at vacuum pressure greater than or equal to the highest vacuum pressure observed during the run and the contents of the impingers were measured for moisture gain. The XAD sorbent module was sealed on both ends and placed on ice. The filter was removed from the filter holder and placed in sample container 1. The nozzle, probe liner, filter holder, condenser and all connecting glassware were triple-rinsed and brushed with acetone, and these rinses were recovered in sample container 2. All glassware cleaned for sample container 2 was also triple-rinsed with toluene and recovered into sample container 3. All containers were sealed, labeled and liquid levels marked for transport to the identified laboratory for analysis.

A field blank was collected prior to initiating testing. A complete sampling system was placed at the sampling location and multiple leak checks were performed on the system similar to an actual testing scenario. The sample train was then moved to the mobile laboratory for recovery. A full set of reagent blanks including a filter and a trap were also submitted to the laboratory.

### **3.10 U.S. EPA Reference Test Methods 25A and 320 – Non-Methane Volatile Organic Compounds**

The non-methane volatile organic compounds (NMVOC) testing was conducted in accordance with U.S. EPA Reference Test Method 25A. Data was collected online and reported in one-minute averages. The sampling system consisted of a stainless-steel probe, heated Teflon sample line(s) and the identified gas analyzer. The quality control measures are described in Section 3.15.

Methane concentration was determined by integrated Tedlar bag sampling and U.S. EPA Reference Test Method 320 analysis. The average methane concentration was subtracted from the average total hydrocarbon concentration to provide a NMVOC concentration.

### **3.11 U.S. EPA Reference Test Method 26 – Hydrogen Chloride**

The hydrogen chloride (HCl) testing was conducted in accordance with U.S. EPA Reference Test Method 26. The complete sampling system consisted of a heated glass-lined probe, heated Teflon filter, gas conditioning train, pump and calibrated dry gas meter. The gas conditioning train consisted of four (4) chilled impingers. The first and second impingers contained 100 mL of 0.1 N H<sub>2</sub>SO<sub>4</sub>, the third was initially empty and the fourth contained 200-300 grams of silica gel. The probe liner and filter heating systems were maintained at 248-273°F, and the impinger temperature was maintained at 20°C (68°F) or less throughout the testing.

Following the completion of each test run, the sampling train was leak checked at a vacuum pressure greater than or equal to the highest vacuum pressure observed during the run and the contents of the impingers were measured for moisture gain. The absorbing solution (0.1 N H<sub>2</sub>SO<sub>4</sub>) from the first and second impingers was placed into sample container 1. The back-half of the filter holder, first, second and third impingers and all glassware leading to the outlet of the third impinger were rinsed with de-ionized (DI) water. These rinses were also placed in container 1. All containers were sealed, labeled and liquid levels marked for transport to the identified laboratory for analysis.

### 3.12 U.S. EPA Reference Test Methods 201A and 202 – PM < 10 Microns / PM < 2.5 Microns

The PM<sub>2.5</sub> and PM<sub>10</sub> testing was conducted in accordance with U.S. EPA Reference Test Methods 201A and 202. The complete sampling system consisted of a stainless-steel nozzle, PM<sub>10</sub> and PM<sub>2.5</sub> in-stack cyclones, in-stack filter holder, pre-weighed quartz filter, heated glass-lined probe extension, un-weighed Teflon filter, gas conditioning train, pump and calibrated dry gas meter. The gas conditioning train consisted of a coiled condenser and four (4) chilled impingers. The first, second and fourth impingers were initially empty, the third contained 100 mL of de-ionized (DI) water and the last impinger contained 200-300 grams of silica gel. The un-weighed 90 mm Teflon filter was placed between the second and third impingers. The probe liner heating system was maintained at a temperature of 248 ±25°F, and the impinger temperature was maintained at 68°F or less throughout testing. The temperature of the Teflon filter was maintained greater than 65°F but less than or equal to 85°F.

Following the completion of each test run, the sampling train was leak checked at a vacuum pressure greater than or equal to the highest vacuum pressure observed during the run. The nitrogen purge was omitted if minimal to no condensate was collected in the dry impinger.

The pre-weighed quartz filter was carefully removed and placed in container 1. The front half of the filter holder and back-half of the PM<sub>2.5</sub> cyclone were rinsed six (6) times with acetone to remove any adhering particulate matter, and these rinses were recovered in container 2. The back-half of the PM<sub>10</sub> cyclone, front half of the PM<sub>2.5</sub> cyclone and the connecting stainless-steel tubing were rinsed six (6) times with acetone, and these rinses were recovered in container 3. All containers were sealed, labeled and liquid levels marked for transport to the identified laboratory for filterable particulate matter analysis.

The contents of impingers 1 and 2 were recovered in container 4. The back half of the filterable PM filter holder, probe extension, coil condenser, impingers 1 and 2 and all connecting glassware were rinsed with DIUF water and then rinsed with acetone, followed by hexane. The water rinses were added to container 4 while the solvent rinses were recovered in container 5. The Teflon filter was removed from the filter holder and placed in container 6. The front half of the condensable PM filter holder was rinsed with DIUF water and then with acetone, followed by hexane. The water rinse was added to container 4 while the solvent rinses were added to container 5. All containers were sealed, labeled and liquid levels marked for transport to the identified laboratory for condensable particulate matter analysis.

### 3.13 U.S. EPA Reference Test Method 205 – Gas Dilution System Certification

A calibration gas dilution system field check was conducted in accordance with U.S. EPA Reference Method 205. Multiple dilution rates and total gas flow rates were utilized to force the dilution system to perform two dilutions on each mass flow controller. The diluted calibration gases were sent directly to the analyzer, and the analyzer response recorded in an electronic field data sheet. The analyzer response agreed within 2% of the actual diluted gas concentration. A second Protocol 1 calibration gas, with a cylinder concentration within 10% of one of the gas divider settings described above, was introduced directly to the analyzer, and the analyzer response recorded in an electronic field data sheet. The cylinder concentration and the analyzer response agreed within 2%. These steps were repeated three (3) times. Copies of the Method 205 data can be found in the Quality Assurance/Quality Control Appendix.

### 3.14 Quality Assurance/Quality Control – U.S. EPA Reference Test Methods 3A and 7E

Cylinder calibration gases used met EPA Protocol 1 (+/- 2%) standards. Copies of all calibration gas certificates can be found in the Quality Assurance/Quality Control Appendix.

Low Level gas was introduced directly to the analyzer. After adjusting the analyzer to the Low-Level gas concentration and once the analyzer reading was stable, the analyzer value was recorded. This process was repeated for the High-Level gas. For the Calibration Error Test, Low, Mid, and High Level calibration gases were sequentially introduced directly to the analyzer. All values were within 2.0 percent of the Calibration Span or 0.5 ppmv absolute difference.

High or Mid Level gas (whichever was closer to the stack gas concentration) was introduced at the probe and the time required for the analyzer reading to reach 95 percent or 0.5 ppm (whichever was less restrictive) of the gas concentration was recorded. The analyzer reading was observed until it reached a stable value, and this value was recorded. Next, Low Level gas was introduced at the probe and the time required for the analyzer reading to decrease to a value within 5.0 percent or 0.5 ppm (whichever was less restrictive) was recorded. If the Low-Level gas was zero gas, the response was 0.5 ppm or 5.0 percent of the upscale gas concentration (whichever was less restrictive). The analyzer reading was observed until it reached a stable value and this value was recorded. The measurement system response time and initial system bias were determined from these data. The System Bias was within 5.0 percent of the Calibration Span or 0.5 ppmv absolute difference

High or Mid Level gas (whichever was closer to the stack gas concentration) was introduced at the probe. After the analyzer response was stable, the value was recorded. Next, Low Level gas was introduced at the probe, and the analyzer value recorded once it reached a stable response. The System Bias was within 5.0 percent of the Calibration Span or 0.5 ppmv absolute difference or the data was invalidated and the Calibration Error Test and System Bias were repeated.

Drift between pre- and post-run System Bias was within 0.5 ppmv absolute difference or the Calibration Error Test and System Bias were repeated.

To determine the number of sampling points, a gas stratification check was conducted prior to initiating testing. The pollutant concentrations were measured at three points (16.7, 50.0 and 83.3 percent of the measurement line). Each traverse point was sampled for a minimum of twice the system response time.

If the pollutant concentration at each traverse point did not differ more than 5% or 0.5 ppm (whichever was less restrictive) of the average pollutant concentration, then single point sampling was conducted during the test runs. If the pollutant concentration did not meet these specifications but differed less than 10% or 1.0 ppm from the average concentration, then three (3) point sampling was conducted (stacks less than 7.8 feet in diameter - 16.7, 50.0 and 83.3 percent of the measurement line; stacks greater than 7.8 feet in diameter - 0.4, 1.0, and 2.0 meters from the stack wall). If the pollutant concentration differed by more than 10% or 1.0 ppm from the average concentration, then sampling was conducted at a minimum of twelve (12) traverse points. Copies of stratification check data can be found in the Quality Assurance/Quality Control Appendix.

An NO<sub>2</sub> – NO converter check was performed on the analyzer prior to initiating and at the completion of testing. An approximately 50 ppm nitrogen dioxide cylinder gas was introduced directly to the NOx analyzer and the instrument response was recorded in an electronic data sheet. The instrument response was within +/- 10 percent of the cylinder concentration.

A Data Acquisition System with battery backup was used to record the instrument response in one (1) minute averages. The data was continuously stored as a \*.CSV file in Excel format on the hard drive of a computer. At the completion of testing, the data was also saved to the AST server. All data was reviewed by the Field Team Leader before leaving the facility. Once arriving at AST's office, all written and electronic data was relinquished to the report coordinator and then a final review was performed by the Project Manager.

### **3.15 Quality Assurance/Quality Control – U.S. EPA Reference Test Method 25A**

Cylinder calibration gases used met EPA Protocol 1 (+/- 2%) standards. Copies of all calibration gas certificates can be found in the Quality Assurance/Quality Control Appendix.

Within two (2) hours prior to testing, zero gas was introduced through the sampling system to the analyzer. After adjusting the analyzer to the Zero gas concentration and once the analyzer reading was stable, the analyzer value was recorded. This process was repeated for the High-Level gas, and the time required for the analyzer reading to reach 95 percent of the gas concentration was recorded to determine the response time. Next, Low and Mid-Level gases were introduced through the sampling system to the analyzer, and the response was recorded when it was stable. All values were less than +/- 5 percent of the calibration gas concentrations.

Mid Level gas was introduced through the sampling system. After the analyzer response was stable, the value was recorded. Next, Zero gas was introduced through the sampling system, and the analyzer value recorded once it reached a stable response. The Analyzer Drift was less than +/- 3 percent of the span value.

A Data Acquisition System with battery backup was used to record the instrument response in one (1) minute averages. The data was continuously stored as a \*.CSV file in Excel format on the hard drive of a computer. At the completion of testing, the data was also saved to the AST server. All data was reviewed by the Field Team Leader before leaving the facility. Once arriving at AST's office, all written and electronic data was relinquished to the report coordinator and then a final review was performed by the Project Manager.